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**From:** Lindstrom, Andrew [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=04BF7CF26AA44CE29763FBC1C1B2338E-LINDSTROM, ANDREW]  
**Sent:** 4/20/2016 6:28:01 PM  
**To:** Xindi Hu [Ex. 6 Personal Privacy (PP)]  
**CC:** Christopher Higgins [chiggins@mines.edu]  
**Subject:** RE: PFAS manufacturing plants  
**Attachments:** OECD HAZARD ASSESSMENT OF PERFLUOROOCTANE SULFONATE (PFOS) AND ITS SALTS.pdf; 226-1483.pdf; 226-1484.pdf; 226-1260.pdf; 226-1534.pdf; 3M History of PFOS as of 1999 AR226\_0548.pdf; Braun et al. 2015 Child Adiposity at 8 Years of Age.pdf; Nakayama et al. 2010.pdf

Cindy,

The selection of which production facilities to include in this assessment is very important and I'm still not convinced that what we have now is adequately justified. I've put the draft article into our internal review process and the reviewers have asked me to describe how these production facilities were selected for inclusion. I don't have a good answer for them.

I've attached PDFs of the references used as support for this selection and I think they clearly support 3M facilities in Decatur and Cottage Grove as well as the DuPont factories in Parkersburg and Deepwater New Jersey - but the other sites I can't find. We may need some more references depending on what you decide to include in the model. Please let me know if I can help with this.

That said, as far as I know 3M was the only producer of PFOS in North America and they stopped in 2002.

AR226-0548 (also attached) says that PFOS was produced by 3M principally at their Decatur plant in AL and to a smaller extent the Cottage Grove plant in MN (pages 13-14). I'm pretty sure both of these plants also produced PFOA, but I don't have any supporting documentation other than water quality data from MN Department Health and the Alabama Department of Environmental Management. I could probably find more references on this if we need them.

Also, the Solvay plant in West Deptford New Jersey was probably the only big plant on my list (below) to emit PFNA. This is substantiated by water quality testing by the NJ Department of Environmental Protection. Again, I could find some references for this if needed.

All the other sites on the list below probably made or used PFOA, but getting documentation on that is going to be tough. Most (all?) of these plants probably also made many other things in smaller batches or as experimental test runs. I don't know how to document their production histories.

Airborne emissions are important, and characterizing them will be very important when trying to assess long-range transport and regional contamination. But please also bear in mind that aqueous effluents from these big plants travel for 100s of km too. Parkersburg, for example has most likely influenced PFOA exposures to at least Cincinnati, Ohio – about 320 km away by highway. Check out the paper by Braun et al. about adiposity in women in Cincinnati attached above. We also note that liquid emissions from 3M in Cordova, IL (Nakayama 2010) and DuPont in Fayetteville, NC (Strynar 2105) travel long distances downstream to potentially influence exposures via drinking water.

All that said, I'm guessing that the vast majority of what we're seeing in the UCMR3 data is related to local emissions – that is, less than 50 km distant. The MRLs are so high that both regional airborne emissions and long distance transport in river systems probably get so diluted that they won't show up much in these data. I do

think long range transport is very important – but I really think most of what we see in the UCMR3 is going to be local. These are very important questions that we need to figure out.

Again, I want to stress that based on my experience in the field and my examination of these data, I think the majority of what we have with the UCMR3 is going to local and a great deal of this is going to be linked to AFFF use. I think most of the hits in UCMR3 are for PFOS and I don't think this is mentioned in the draft. It would be a good idea to look at the PFOS/PFHxS ratios to see if they match AFFF proportions – PFOS is typically about 3 x higher than PFHxS in AFFF. We'd need a broader range of analytes to say anything more conclusive about PFOS sources – again, another limitation of this dataset.

Please let me know how I can help.

Thanks,

Andy

#### List of facilities known to participate in the USEPA's Stewardship Agreement

City	State	Company
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Parkersburg	WV	Dupont
Washington Works, Parkersburg, 8480 DuPont Rd Washington, WV 26101, 39.266469, -81.665904		

Deepwater	NJ	Dupont
Chambers Works, Deepwater, 603 Heron Dr #1 Bridgeport, NJ 08014, 39.770261, -75.35608		

Richmond (Spruance)	VA	Dupont
5200 DuPont Site Rd, Richmond, VA 23234, 37.450298, -77.437892		

Decatur	AL	Dupont (my source says Dupont, but I think this must be 3M),
1400 State Docks Rd Decatur, AL 35601, 34.641782, -87.044871		

Calvert KY		Arkema
4444 Industrial Pkwy, Calvert City, KY 42029, 37.055394, -88.366971		

Thorofare	NJ	Solvay Solaxis
10 Leonard Ln, West Deptford, NJ 08086, 39.844013, -75.209851		

Somerville NJ Clariant  
Fair Lawn Avenue and Third Street in Fair Lawn, Bergen County, New Jersey  
40.934805, -74.137963 NOT SURE ABOUT THIS ONE

Charlotte NC Clariant  
625 Catawba Avenue, Mount Holly, NC 28120  
35.294247, -81.007943

McIntosh AL Ciba (now BASF)  
1379 Ciba Road, McIntosh, AL, 36553  
31.278142, -87.999580

Cottage Grove MN 3M  
Cottage Grove, MN, PO Box 33427 St Paul,  
44.788908, -92.911710

Cordova IL 3M  
22614 Route 84 N, Cordova, IL 61242,  
41.751568, -90.289291

Bayonne NJ Asahi  
(Plant demolished 2007, now brownfield with significant contamination)  
229 East 22nd Street, Bayonne, New Jersey,  
40.660391, -74.107251

Parlin NJ Dupont  
500 Cheesequake Road Parlin, New Jersey 08859  
40.452134, -74.330899

Fayetteville NC  
22828 NC-87 Fayetteville, NC 28306,  
34.840297, -78.842319

Pascagoula MS Dupont  
1001 Industrial Rd, Pascagoula, MS 39581 (now Chemours)  
30.354016, -88.495710

El Dorado AR Dupont  
322 Southfield Cutoff, El Dorado, AR 71730 (now Chemours)  
33.110213, -92.675014

Cartersville GA Innovative Chemical Technologies  
103 Walnut Grove Rd SE, Cartersville, GA 30120  
34.145222, -84.828213

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**From:** Xindi Hu **Ex. 6 Personal Privacy (PP)**  
**Sent:** Tuesday, April 19, 2016 10:37 AM  
**To:** Lindstrom, Andrew <Lindstrom.Andrew@epa.gov>  
**Subject:** Re: PFAS manufacturing plants

Hi Andy,  
I'm revisiting my analysis based on the feedback I received from co-authors.  
I had a very productive phone call with Chris Higgins last Friday, and want to incorporate some of his ideas in the next phase of analysis. However, I feel we really need your expertise knowledge on manufacturing sites.

One thing Chris Higgins suggested is to separate manufacturing plants based on if they only produce PFOA, or if they produce both PFOS and PFOA.

For example, he mentioned the plant at Washington Works in Parkersburg only produces PFOA, while the Decatur plant produces both.

If my secondary analysis is to include all the 17 or 16 sites you mentioned, can you find information on what compounds were produced in each of them?

Another point Chris brought up is smokestack. He believes only plant with smokestack can emit PFASs through atmospheric pathway and thus influencing places 200km away. Is there a way for us to get this kind of information? Like a publicly available database?

Thank you very much for your help!

Best,  
Cindy

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**Cindy Hu, M.S.**

Doctoral candidate in Environmental Health | Harvard T.H. Chan School of Public Health  
Fellow in Environmental Science and Engineering | Harvard John A. Paulson School of Engineering & Applied Sciences

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On Mar 3, 2016, at 11:54 AM, Lindstrom, Andrew <[Lindstrom.Andrew@epa.gov](mailto:Lindstrom.Andrew@epa.gov)> wrote:

Cindy,

I've taken a look at the ten facilities that you've been using as inputs and I've plotted them using Google Maps. I think some of the following observations could help sharpen the model a bit.

1. 3M1, Decatur, AL, 1400 State Docks Rd Decatur, AL 35601, 34.641782, -87.044871

This looks good, but it may be worth noting there are other fluorochemical facilities nearby – Toray and Daikin America. It is very common to have collocated production facilities.

2. 3M2, Cottage Grove, MN, PO Box 33427 St Paul, MN 55133, 44.958597, -92.995353  
The Cottage Grove plant which is responsible for most (?) of the emissions in this area is actually at 44.788908, -92.911710. Given the scale of the modeling, I don't know if this is relevant.

3. 3M3, Cordova, IL, 3M 22614 Route 84 N, Cordova, IL 61242, 41.751568, -90.289291

Looks fine.

4. 3M4, Pensacola, FL, 3000 Old Chemstrand Rd, Cantonment, FL 32533, 30.631464, -87.254791

The GPS looks to be about 2 km north of the actual plant – it may be the official outfall point for the plant, I don't know how to tell.

5. 3M5, Columbus, GA, 3M Co 3700 Atlanta Industrial Pkwy NW Atlanta, GA 30331, 33.799707, -84.496028

The GSP tracks to a warehouse looking structure called “Med Supply Partners”. There is 3M facility just to the north, but it looks like a warehouse, not a production facility. I am not aware of any 3M fluorochemical production in the Atlanta area or the state of Georgia. I doubt that this site is a major source.

6. 3M6, Guin, AL, 3M Co 6675 US-43 Guin, AL 35563, 33.966864, -87.9024

This looks like a very small production facility and it may not be a major source.

7. DuPont1, Chambers Works in Deepwater, NJ, 603 Heron Dr #1 Bridgeport, NJ 08014, 39.770261, -75.35608

The GPS tracks to the general vicinity but does not appear to correspond to the Chambers Works site.

I think it actually this: 39.691381, -75.503249

8. DuPont2, Washington Works in Parkersburg, WV, 8480 DuPont Rd Washington, WV 26101, 39.266469, -81.665904

Looks fine.

9. DuPont3, Fayetteville, NC, 22828 NC-87 Fayetteville, NC 28306, 34.840297, -78.842319

Looks fine.

10. DuPont4, Little Hocking, OH, E I Dupont De Nemours & Co RR 50 Little Hocking, OH 45742, 39.285488, -81.724003

GSP location is in the woods about 3 km northwest of the DuPont Washington Works plant in Parkersburg, WV. This may be a dump site or some other DuPont holding. It does not look like a major production facility and it is probably redundant given the nearby Washington Works plant.

Points to consider adding:

Solvay Specialty Polymers, 10 Leonard Ln, West Deptford, NJ 08086, 39.844013, -75.209851

This is a known source of PFNA contamination that is apparent in the UCMR3 database.

Arkema America, 4350 Camp Ground Rd, Louisville, KY 40216, 38.211586, -85.844380

There are probably other sites to consider, but we should think about how to do this.

As I said before, I think it would be good to somehow add all of the major sites for the companies participating in the Stewardship Agreement, but I don't think there is a way to do it.

Try plotting BASF on google maps and see how many sites they have across the US. Which of these is important? Probably more than a few, but I don't know how to identify them.

In the end I'm afraid we're going to be stuck with a somewhat arbitrary way of choosing sites to include as potential industrial sources. And I think the companies that actually use these bulk products (like carpet and textile manufacturers or polymer operations) are going to be at least as significant and these primary producers. There may not be anything we can do about this, but we need to be aware that these biases are part of the process.

Thank you,

Andy

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**From:** Xindi Hu [mailto:[Ex. 6 Personal Privacy \(PP\)](#)]  
**Sent:** Wednesday, March 02, 2016 6:23 PM  
**To:** Lindstrom, Andrew <[Lindstrom.Andrew@epa.gov](mailto:Lindstrom.Andrew@epa.gov)>  
**Cc:** Elsie M Sunderland <[ems@seas.harvard.edu](mailto:ems@seas.harvard.edu)>; Laurel Schaider <[schaider@silentspring.org](mailto:schaider@silentspring.org)>; [rlohmann@uri.edu](mailto:rlohmann@uri.edu)  
**Subject:** Re: PFAS manufacturing plants

Hi Andy,

Thanks a lot for your detailed reply.

I agree with you that major sites will be compound specific, and thanks for providing the PFNA example.

The current 10 sites are attached as a csv file to this email.

I will let you know after I hear back from my colleague at Harvard.

Thanks again for your contribution to this work.

Best,  
Cindy